

WHAT IS CLAIMED IS:

1. An in-line system for manufacturing liquid crystal displays, comprising:  
a spacer-dispersing unit for dispersing spacers on one of two substrates of a  
mother glass, the mother glass having at least one liquid crystal cell;

5 a sealant-applying unit for depositing sealant on one of the two substrates;  
a liquid crystal depositing unit for depositing liquid crystal material on the  
substrate where the sealant is deposited; and

10 a substrate-attaching unit for receiving the two substrates from the sealant-  
applying unit or the liquid crystal depositing unit, then conjoining the substrates in a  
vacuum state.

2. The in-line system of claim 1, further comprising:

a first loading unit where one of the two substrates is loaded, and a second  
loading unit where one of the two substrates is loaded; and

15 a substrate-combination unit for providing the two substrates to the substrate-  
attaching unit.

3. The in-line system of claim 2, further comprising a sealant heat-treating  
unit for forming a reaction-prevention layer on a surface of the sealant such that a  
reaction between the sealant and the liquid crystal material is prevented.

4. The in-line system of claim 3, wherein the first loading unit, the spacer-  
20 dispersing unit, the sealant-applying unit, the liquid crystal depositing unit, the  
substrate-combination unit, and the substrate-attaching unit are combined in this  
sequence through first, second, third, fourth and fifth in-line conveying units, which

transport the substrates to these elements in predetermined in-line process time units.

5. The in-line system of claim 4, wherein the second loading unit is connected to the substrate-combination unit through a sixth in-line conveying unit.

6. The in-line system of claim 3, wherein the first loading unit, the sealant-applying unit, the liquid crystal depositing unit, the substrate-combination unit, and the substrate-attaching unit are combined in this sequence through first, second, third and fourth in-line conveying units, which transport the substrates to these elements in predetermined in-line process time units.

7. The in-line system of claim 6, wherein the second loading unit, the spacer-dispersing unit and the substrate-combination unit are connected in sequence through fifth and sixth in-line conveying units.

8. The in-line system of claim 1, wherein the substrate-attaching unit includes two or more vacuum chambers for conjoining the substrates in a vacuum state in a predetermined in-line process unit.

15 9. The in-line system of claim 8, wherein the vacuum chambers are connected in series such that the substrates are provided to a subsequent process in a predetermined vacuum state, each vacuum chamber holding the substrates for a predetermined in-line process time.

20 10. The in-line system of claim 8, wherein the vacuum chambers are connected in parallel such that the substrates are provided to a subsequent process in a predetermined vacuum state, each vacuum chamber holding the substrates for a

predetermined in-line process time.

11. The in-line system of claim 1, wherein the substrate-attaching unit includes a first compression plate and a second compression plate for supporting the two substrates and applying a predetermined force toward each other such that the two substrates are pressed together; and an exposure unit for hardening the sealant.

12. The in-line system of claim 1, wherein the substrate-attaching unit includes a first compression plate and a second compression plate for supporting the two substrates and applying a predetermined force toward each other such that the substrates are pressed together, the first compression plate and the second compression plate having at least one vacuum hole for exhausting air from between the compression plates; a support tube provided between the first compression plate and the second compression plate for sealing a space therebetween, the support tube having an inner space from which air can be exhausted such that an interval between the compression plates can be adjusted; and an exposure unit for hardening the sealant.

13. The in-line system of claim 12, wherein the substrate-attaching unit has a plurality of the vacuum holes at predetermined locations; and air is exhausted from the vacuum holes in a predetermined sequence.

14. The in-line system of claim 13, wherein the vacuum holes are formed at corners or center portions of each side of the first compression plate and the second compression plate.

15. The in-line system of claim 13, wherein the vacuum holes are shaped as slits of a predetermined length.

16. The in-line system of claim 1, wherein the liquid crystal depositing unit includes a liquid crystal depositer that is a syringe-type device such that the liquid crystal material can be deposited at specific predetermined locations in the liquid crystal cell.

17. The in-line system of claim 1, wherein the liquid crystal depositing unit is a spray-type device such that the liquid crystal material can be deposited over an entire surface of the liquid crystal cell.

10. 18. The in-line system of claim 1, wherein the sealant-applying unit deposits the sealant in a closed loop, that is, without a liquid crystal injection hole.

19. The in-line system of claim 1, wherein the sealant is a material that is hardened by infrared rays.

15. 20. The in-line system of claim 1, wherein the sealant includes one or more buffer regions that have a predetermined area to allow for flow of excess liquid crystal material.

21. A liquid crystal depositing unit for manufacturing a liquid crystal display, comprising:

20. a depositer for depositing liquid crystal material in liquid crystal cell of one of two substrates of a mother glass.

22. The liquid crystal depositer of claim 21, wherein said depositer is a syringe-type device such that the liquid crystal material can be deposited at specific predetermined locations in the liquid crystal cell.

5 23. The liquid crystal depositer of claim 21, wherein the depositer is a spray-type device having a plurality of nozzles such that the liquid crystal material can be deposited over an entire surface of the liquid crystal cell.

24. A substrate-attaching unit for manufacturing a liquid crystal display, the substrate-attaching unit attaching, in a vacuum state, two substrates of a mother glass having at least one liquid crystal cell region.

10 25. The substrate-attaching unit of claim 24, wherein the substrate-attaching unit includes a first compression plate and a second compression plate for supporting the two substrates and applying a predetermined force toward each other such that the substrates are pressed together; and an exposure unit for hardening a sealant between the substrates.

15 26. The substrate-attaching unit of claim 24, further comprising: a first compression plate and a second compression plate for supporting the two substrates and applying a predetermined force toward each other such that the substrates are pressed together, a first compression plate and the second compression plate having at least one vacuum hole for exhausting air from between the compression plates;

20 a support tube provided between the compression plates for sealing a space therebetween, the support tube having an inner space from which air can be exhausted

such that an interval between the compression plates can be adjusted; and  
an exposure unit for hardening the sealant.

27. The substrate-attaching unit of claim 26, wherein there are provided a plurality of the vacuum holes at predetermined locations, and air is exhausted from the  
5 vacuum holes in a predetermined sequence.

28. The substrate-attaching unit of claim 27, wherein the vacuum holes are formed at corners or center portions of each side of the first compression plate and the second compression plate.

29. The substrate-attaching unit of claim 28, wherein the vacuum holes are  
10 shaped as slits of a predetermined length.

30. The substrate-attaching unit of claim 24, wherein the substrate-attaching unit includes two or more vacuum chambers for conjoining the substrates in a vacuum state in a predetermined in-line process time unit.

31. The substrate-attaching unit of claim 30, wherein the vacuum chambers  
15 are connected in series such that the substrates are provided to a subsequent process in a predetermined vacuum state, each vacuum chamber holding the substrates for a predetermined in-line process time.

32. The in-line system of claim 30, wherein the vacuum chambers are connected in parallel such that the substrates are provided to a subsequent process in  
20 a predetermined vacuum state, each vacuum chamber holding the substrates for a predetermined in-line process time.

33. A method for manufacturing liquid crystal displays, comprising the steps of:

dispersing spacers on one of two substrates of a mother glass, the mother glass having at least one liquid crystal cell;

5 depositing a sealant on one of the two substrates;

depositing liquid crystal material on the substrate on which the sealant is deposited; and

conjoining the substrates in a vacuum state.

34. The method of claim 33, further comprising the step of forming a reaction-prevention layer on a surface of the sealant by a first hardening process such that a reaction between the sealant and the liquid crystal material is prevented.

35. The method of claim 34, wherein the steps of dispersing the spacers, depositing the sealant, depositing the liquid crystal material and conjoining the substrates are performed as in-line processes.

15 36. The method of claim 35, wherein the steps of dispersing the spacers, depositing the sealant and depositing the liquid crystal material are performed on one of the two substrates.

37. The method of claim 36, wherein the steps of dispersing the spacers and depositing the sealant are performed on one substrate, and the step of depositing the liquid crystal material is performed on the other substrate.

20 38. The method of claim 34, wherein in the step of conjoining the

substrates, the vacuum state is generated in multiple steps of predetermined in-line process time units.

39. The method of claim 34, wherein in the step of conjoining the substrates, the two substrates are provided in the vacuum state in a predetermined in-line process time unit.

40. The method of claim 34, wherein the step of conjoining the substrates includes the steps of aligning the substrates, applying a predetermined force to the substrates in a direction toward each other such that the substrates are attached by the sealant, and exposing the sealant and performing a second hardening process on the sealant.

41. The method of claim 34, wherein the step of conjoining the substrates further comprises/steps of

aligning the substrates;

forming a vacuum between the substrates;

reducing a space between the substrates by controlling the vacuum;

applying a predetermined force to the substrates in a direction toward each other such that the substrates are attached by the sealant; and

exposing the sealant and performing a second hardening process on the sealant.

42. The method of claim 41, wherein the step of forming the vacuum is performed through a plurality of the vacuum holes formed at predetermined locations.

43. The method of claim 42, wherein the step of forming the vacuum is performed by exhausting air from the vacuum holes in a predetermined sequence.

44. The method of claim 34, wherein the step of depositing the liquid crystal material includes the steps of providing droplets of the liquid crystal material at 5 predetermined locations, and rotating the substrate.

45. The method of claim 34, wherein the step of depositing the liquid crystal material includes the step of depositing the liquid crystal material over an entire surface of the liquid crystal cell.

46. The method of claim 34, wherein in the step of depositing the sealant, 10 the sealant is deposited in a closed loop, that is, without a liquid crystal injection hole.

47. The method of claim 34, wherein the sealant is a material that is hardened by infrared rays.

48. The method of claim 34, wherein the sealant includes one or more buffer regions, which have a predetermined area for excessive liquid crystal material.

49. A method for manufacturing a liquid crystal display, comprising the step 15 of conjoining two substrates of a mother glass in a vacuum state to complete a liquid crystal panel, the mother glass having at least one liquid crystal cell, and at least one substrate having liquid crystal material deposited thereon.

50. The method of claim 49, wherein the step of conjoining the substrates 20 further comprises steps of:

aligning the substrates;  
applying a predetermined force to the substrates in a direction toward each other;  
adhering the substrates to one another with the sealant; and  
hardening the sealant to complete the attachment of the substrates.

5 51. The method of claim 50, wherein the step of completing the liquid crystal panel further comprises steps of:

aligning the substrates;  
forming a vacuum between the substrates;  
10 reducing a space between the substrates by controlling the vacuum;  
applying a predetermined force to the substrates in a direction toward each other;  
adhering the substrates to one another with the sealant; and  
hardening the sealant to complete the attachment of the substrates.

15 52. The method of claim 51, wherein the step of forming the vacuum is performed through a plurality of the vacuum holes formed at predetermined locations.

53. The method of claim 52, wherein the step of forming the vacuum is performed by exhausting air from the vacuum holes in a predetermined sequence.

54. The method of claim 50, wherein in the step of completing the liquid crystal panel, the vacuum state is generated in multiple steps of predetermined in-line process time units.

55. The method of claim 50, wherein in the step of completing the liquid crystal panel, the two substrates are provided in the vacuum state in a predetermined in-line process time unit.